THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

041 **BASIC MATHEMATICS**
(For Both School and Private Candidates)

TIME: 3 Hours ***Monday November 03, 2003 a.m.***

Instructions

1. This paper consists of sections A and B.
2. Answer **ALL** questions in section A and **FOUR (4)** questions from section B.
3. All necessary working and answers for each question done must be shown clearly.
4. Mathematical tables and graph papers may be used unless otherwise stated.
5. Electronic calculators are not allowed in the examination room.
6. You are advised to spend not more than 2 hours on section A.
7. Cellular phones are not allowed in the examination room.
8. Write your Examination Number on every page of your answer booklet(s).

SECTION A (60 marks)

Answer **ALL** questions in this section

1. (a) Change $0.\dot{1}2\dot{3}$ into a fraction. (2 marks)

(b) The numbers 28, 41, 42, 59, 70 belong to the set of natural numbers. By using these numbers

(i) calculate the difference between the least common multiple (L.C.M.) of the prime numbers and the greatest common factor (G.C.F.) of the remaining numbers

(ii) express the answer obtained in 1.b (i) above in the standard form $A \times 10^n$ correct to two significant figures where $1 \leq A < 10$ and n is an integer.

(4 marks)

2. (a) Given $A = \{(x, y) : 3x + 4y = 10\}$ and $B = \{(x, y) : 2x - 3y = 1\}$.

Find $A \cap B$. (3 marks)

(b) What number must be added to $x^2 + 17x + 12$ to make the expression exactly divisible by $(x + 5)$? (3 marks)

3. (a) Given $\underline{a} = \frac{1}{2}\underline{i} + \frac{1}{3}\underline{j}$, $\underline{b} = \frac{2}{3}\underline{i} + \frac{1}{3}\underline{j}$ and $\underline{c} = \underline{i} + 6\underline{j}$. Determine a unit vector in the direction of the vector $\underline{d}$ where $\underline{d} = 6\underline{a} + 3\underline{b} - \underline{c}$. (2 marks)

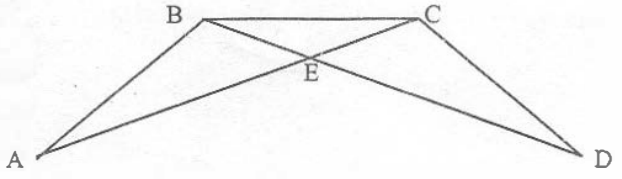
(b) Joff is 30 m from a flag pole installed with its bottom end some distance below ground level. The angle of elevation of the top of the flag pole from Joff's eye level is 12.4° and the angle of depression of its bottom end is 2.1°. Calculate the height of the flag pole.

4. (a) Find the values of x and y given that $x^{(2y+1)} = x^{(3y-1)} = 243$

(2 marks)

(b) If $\log_4 x = y$, show that $\log_2 x = 2y$. Hence find the value of x given that $\log_2 x + \log_4 x = 9$ (4 marks)

5. (a) ABCD is part of a regular polygon. Show that the triangles ABC and BCD are congruent.



(3 marks)

(b) The middle angle of a triangle exceeds the smallest angle by 20° and the largest angle is twice the middle angle. Find the size of the largest angle. (3 marks)

6. (a) Compute the sum of the first ten terms of the series $1 + 5 + 9 + \ldots$. (2 marks)

(b) The 5^{th} term of an arithmetic progression is 23 and the 12^{th} term is 37. Find

(i) the eleventh term

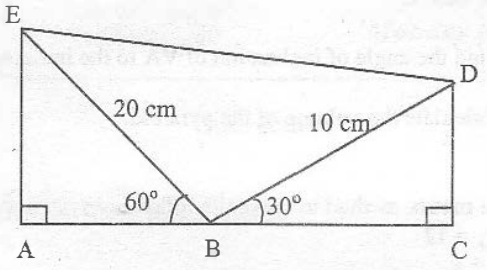
(ii) the sum of the first eleven terms by using the values computed in 6.(b)(i) above without using the common difference for this progression. (4 marks)

7. (a) Find the distance between the points A(3, 7) and B(-2, -5). (2 marks)

(b) The straight line through the points C(1, -2) and D(3, 4) meets the y-axis at point E. Find the coordinates of E.

(4 marks)

8. (a) In the diagram below, ABC is a straight line. BE = 20 cm, BD = 10 cm, $A\hat{B}E = 60°$ and $m(\angle CBD) = 30°$. Calculate the area of the quadrilateral ABDE.



(4 marks)

(b) A cylinder of base radius of 14 cm has a height of 28 cm. Calculate its volume.

(2 marks)

9. (a) Evaluate by factorisation the expression $(365)^2 - (135)^2$. (2 marks)

(b) Factorise completely the expression $12 + x - x^2$. (2 marks)

(c) Find the value of ab if $a^2 + b^2 = 34$ and $a + b = 8$. (2 marks)

10. (a) Solve the expression $x^2 - 6x - 16 = 0$ by completing the square. (2 marks)

(b) A boy cycles 18 km in 90 minutes and then rests for 10 minutes. Thereafter he cycles 12 km in 50 minutes. Find the average speed for the whole journey in km/h. (2 marks)

(c) Find the maximum value of the quadratic equation $2 + 30t - 5t^2$. (2 marks)

SECTION B (40 marks)

Answer **FOUR (4)** questions from this section.

11. Two tailors A and B spend shs. 15,000/= and shs. 20,000/= per day to make a shirt and a gown respectively. A can stitch 6 shirts and 4 gowns per day while B can stitch 10 shirts and 4 gowns per day. How many days shall each work if it is desired to stitch at least 60 shirts and 32 gowns at a minimum cost?

(10 marks)

12. The table below shows the distribution of 100 shops and their profit per shop recorded in a certain month.

Profit per shop in thousands of shs.	30-34	35-39	40-44	45-49	50-54	55-59
Number of shops	12	18	C	C-7	C-10	6

(a) Find the value of C. (2 marks)

(b) Prepare the frequency distribution and use it to determine the modal class.

(4 marks)

(c) Draw a histogram and frequency polygon on the same diagram. (4 marks)

13. (a) A and B are two points on latitude 70°N. Their longitudes are 62°W and 118°E respectively. Calculate the distance in kilometres from A to B if the Earth's diameter is 12800 km for the following cases:

(i) Along a great circle route over north pole.

(ii) Along a parallel of latitude. (5 marks)

(b) A pyramid has a square base ABCD of side 10 cm. The vertex V is 12 cm above the centre of the base E.

(i) Find the angle of inclination of VA to the horizontal.

(ii) Calculate the volume of the pyramid. (5 marks)

14. (a) Use inverse matrix method to solve the following system of equations:

$$\begin{cases} 2x + 3y = 12 \\ 3x = 7 + y \end{cases}$$

(4 marks)

(b) Determine the value of k for which the matrix

$$\begin{bmatrix} k+3 & 0 \\ \bullet & 2 \end{bmatrix}$$ has no inverse (2 marks)

(c) A linear transformation T maps (x, y) onto (x', y') where $x' = x - y$ and $y' = x + 2y$.

(i) Write down the matrix of T

(ii) Find the image of (5, 3) under T

(iii) Find the point (x, y) whose image under T is (-5, 16). (4 marks)

15. (a) Calculate the value of angle A in a triangle for which $a = 5$, $b = 8$ and $c = 7$. (4 marks)

(b) A function f is defined by $f(x) = x^2 + 6$ and g(x) is another function of x such that

$$g(x) = \frac{f(x) - f(4)}{x - 4}.$$

Find (i) g(-4) (ii) $g^{-1}(5)$ (4 marks)

(c) Compute the range of the function $f(x) = x^2 - 4x + 3$ for which the domain is $\{-2, -1, 0, 1, 2, 3\}$ (2 marks)

16. (a) A box has 8 red balls and 11 white balls of the same size. A ball is drawn at random from the box. What is the probability that it is
(i) red
(ii) white? (4 marks)

(b) A fair die and coin are tossed once. What is the probability of a head on the coin and an even number of the die showing up? (6 marks)